INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

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Resolution of Public Consultation Comments for

ICRP Publication 142 Radiological Protection from Naturally Occurring Radioactive Material (NORM) in Industrial Processes

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Background

ICRP is grateful for the time and effort taken to review and comment on the draft of this publication during the public consultation period. Active public consultations are a valuable part of developing high-quality publications. Comments are welcome from individuals and organisations, and all are considered in revising the draft prior to publication.

To ensure transparency, comments are submitted through the ICRP website and visible by visiting www.icrp.org.

This document summarises the general themes of the comments and how they were considered during preparation of the final report for publication.

Public Consultation

This draft report was available for public consultation from 20 November 2018 to 22 February 2019. The following individuals and organisations provided comments: John Selby; James Uhlemeyer; Jan van der Steen; FANC; Tata Steel; Michael Cowie; Augustin Janssens; International Radiation Protection Association (IRPA); Dutch Society for Radiation Protection (NVS); RIVM and ANVS; Shinichiro Miyazaki; Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU); Rio Tinto; ANSTO; Victorian Department of Health and Human Services, AUSTRALIA; Minerals Council of Australia; Istituto Superiore di Sanità (National Institute of Health), Italy; IRSN, France; European NORM Association (ENA); Public Health England; SSM, Sweden; Health Canada; Noise Abatement and Radiation Safety Dept., Ministry of Environmental Protection; Australian Radiation Protection and Nuclear Safety Agency (ARPANSA); and, SCK•CEN.

Resolution of Comments

Globally, the comments received welcomed the integrated and graded approach recommended for the management of exposure from NORM. However, several criticisms were expressed, in particular related to the type of exposure situation.

Integrated and graded approach

The fundamental approach of taking an integrated and graded approach to radiological protection was supported and encouraged by the majority of commenters. The main message of the report continues to be to manage the industries involving NORM using an integrated and graded approach. Since such industries may give rise to multiple hazards and the

radiological hazard is not necessarily dominant, consideration of non-radiological hazards should be integrated with the radiological hazards, and the approach to protection optimised (graded) so that the use of various radiological protection programme elements is consistent with the hazards while not imposing unnecessary burdens.

For workers the approach starts with the characterisation of the exposure situation, and the integration, as necessary, of specific radiological protective actions to complement the protection strategy already in place or planned to manage other workplace hazards. The approach should be graded according to the characteristics of the exposure e.g. the level of risk, the distribution of the individual doses, and whether the exposure is in a multi-hazard context.

The gradation of the protection of workers is ensured through several elements. The selection of the reference level should reflect the distribution of exposures. The selection of the requisites should start with collective protection and continue using individual protection as necessary. These requisites should be implemented only to the extent necessary to achieve acceptable protection, with modalities adapted to the circumstances.

For public exposure, the integrated and graded approach is implemented through the control of different pathways of exposure, for instance discharges, waste, and residues, including the reuse of residues (e.g. in building materials).

Several comments suggested the same approach for protection of the environment. In the draft, protection of the environment was not specifically included in the discussion of an optimised approach to controls. The final report adopts a graded approach for the environment.

Type of exposure situation

The view expressed in the draft considering exposure arising from industries involving NORM as existing exposure situations was the subject of many critical comments. Most of the comments considered that activities involving NORM are planned exposure situations or should be managed as such. They referred to the IAEA-BSS and the Euratom-BSS. The rationales for these views were diverse: the exposure can be planned; the NORM are deliberately introduced into an industrial process; these industries are authorised; to manage them as planned exposure situations is the only way to achieve an adequate control; the application of the dose limits is relevant to control NORM exposure and it is a principle applicable in planned exposure situations; and the definitions of existing exposure situation and planned exposure situation in the report were wrongly referred to *Publication 103* since they were changed.

The revised report refers directly to the discussions in *Publication 103*, which considered exposures resulting from many industries involving NORM as examples of existing exposure situations (paragraphs 284 and 288). The system of radiological protection applies to all controllable sources, in all exposure situations, and a consistent approach for the management of all types of exposure situations is recommended. This approach is mainly based on the application of the principle of optimisation using appropriate dose criteria.

The revised report describes the key features of industries involving NORM and provides some indication of how radiological protection programmes and regulatory structures could be applied. An integrated and graded approach is appropriate and particularly relevant for industries involving NORM. As explained in the report, the application of regulatory tools, if relevant, does not change the features and characteristics of the exposure situation, but may, for convenience, change the regulatory designation. Exposure situations are helpful for considering the relationship between sources and exposures and the corresponding implementation of radiological protection principles, but flexibility is recommended in the use of regulatory tools to effectively achieve protection.

Radon and thoron

The second largest group of comments related to the treatment of radon only by referring to *Publication 126*. *Publication 126* addresses radon exposure in general and so is relevant for radon exposures in industries involving NORM. However, a few references to that publication were not seen as sufficient. Radon may be a major source of exposure in facilities with NORM. The source of radon may be the soil, the processed NORM or the building materials. Some building materials may be made with NORM residues. ICRP agrees that additional explanation of the approach, coherent with *Publication 126*, is appropriate, and modifications have been made in sections related to the protection of workers and the public.

Another issue was related to the combined exposure from radon and other radionuclides. Some comments suggested considering doses from all sources together. However, in practice, merging all exposures may complicate the implementation of the optimisation principle. According to *Publication 126* (paragraph 60), “in cases where radon exposure is concomitant with exposure in a planned exposure situation (e.g. radon exposure in a nuclear facility or in a hospital radiology department), the Commission recommends a pragmatic approach. Radon exposures of workers should only be part of their overall occupational exposure if this is necessary within the specific graded approach for workplaces.” The final report provides the same recommendation, saying that inhalation of radon and thoron has to be considered, although it is recommended that it be addressed separately (paragraph 85).

Glossary - Definitions

A number of comments concerned the definitions of terms and the glossary that was included in the draft report. ICRP is presently engaged in the development of a general glossary, and in that process is considering some definitions that have evolved over time compared to those in the text or the glossary of *Publication 103*. Some comments from the public consultation suggested using the IAEA definitions. In the ICRP glossary, some descriptions are the same as those of the IAEA but not all because the IAEA glossary is often focused on a regulatory purpose. More particularly, the definition of NORM was considered too restrictive (without considering raw materials).

The definition of NORM has been revised as follows: Material containing no significant amounts of radionuclides other than naturally occurring radionuclides, that may be raw material or material in which the activity concentrations of the naturally occurring radionuclides have been changed by some process and that their contribution to the

exposure of people and the environment is not negligible from a radiological protection point of view.

The ICRP glossary should become available as part of ICRPædia (www.icrpaedia.org) in the near future. Therefore, the glossary was removed from the final publication.

Reference Levels

Several comments and questions related to the reference level. ICRP notes that the reference level applies to the dose added to the natural background (paragraph 60).

Some comments claimed that using reference levels rather than dose limits may result in different dose restrictions among industries and create distortion of competition. Such a view illustrates two concerns. First, a dose limit may or may not be appropriate, given the wide variety of activities that occur with NORM. Application of a limit is a choice of a regulatory tool for judging the adequacy of radiological protection programs. While it may, as a corollary, provide a consistent baseline across an industry, the programs should, in fact, be based on optimisation of protection, using relevant dose criteria (reference levels) based on the characteristics of the specific situation. The report recommends flexibility regarding the use of dose limits in circumstances when the source is well characterised and controlled, and there is an ongoing potential for significant levels of exposure (paragraph 62).

According to some comments, the reference level should be kept within the band of 1-20 mSv y^{-1}, neither more nor less. Indeed, this band is recommended in *Publication 103* to be appropriate in general for existing exposure situations. However, it does not mean that a reference level cannot be selected out of this band, particularly when lower values are appropriate.

Building materials

Some comments pointed out the inconsistency between the reference level for public exposure, recommended at a few mSv y^{-1}, and the reference level for building materials recommended at 1 mSv y^{-1}. They were right. In the report (paragraph 107), it is explained that the protection of the public should be addressed as a whole, i.e. taking into account the different pathways, and that in practice, the most exposed individuals to each pathway (discharge, waste, residue, legacy site) belong to different groups so that the reference level for public exposure can generally be applied to any given pathway. In addition, the reuse and recycling of NORM residues may be the starting point of a new NORM process. According to that approach, the use of building materials containing NORM residues may be considered either as one exposure pathway or as a new NORM process so that the reference level for public exposure can be used, i.e. a few mSv y^{-1} instead of 1 mSv y^{-1}.

The issue of the index was also raised in several comments. The draft report was too detailed in the description of the use of an index for assessing the dose to be compared with the reference level and it seemed to promote this method, or some existing indexes in the literature. It is not the role of ICRP to recommend one index or another, and the focus of the system of radiological protection is optimisation with relevant dose criteria (reference levels). This part of the report has been modified to simply note that some type of index may be useful in certain contexts. (paragraph 122).

About radon exposure from building materials, the final publication explains that the national radon action plan established as recommended in *Publication 126* should include radon and thoron exposure from building materials as relevant.

Protection of workers

The integrated and graded approach, as described in detail for the protection of workers, was welcomed. However, some comments expressed a preference for the use of dose limits rather than reference levels (see above) and some asked for more precision regarding the decision considering workers as occupationally exposed. As explained in the report, the graded approach through the selection of suitable dose reference levels and the selection of the requisites (appropriate protective actions, and the integrated implementation of them), can help determine whether the workers should be considered as occupationally exposed to radiation (paragraph 74). Later (paragraph 103), it is added that workers are likely to be considered as occupationally exposed when, despite all reasonable efforts to reduce exposure, elevated individual doses persist and when the application of special working procedures are needed to perform the job. In the case of radon exposure, *Publication 126* recommends that workers may also be considered as occupationally exposed in some workplaces identified in a national list of activities or facilities in which workers are inevitably and substantially exposed to radon, and this exposure is more intimately and obviously related to their work activities.

Another point raised was the issue of worker exposure scenarios, which were considered inappropriate by some comments. No alternatives were proposed, and the report has not been modified. The scenarios should only be seen as examples.

Protection of the environment

Several comments criticized the report for recommending the systematic completion of an environmental impact assessment in a sophisticated form, without introducing a graded approach.

Some suggested adopting the same integrated and graded approach as for the protection of workers and public. The report has been modified accordingly (see section 4.3). The spirit is now to integrate the radiological impact into the methodology used in the industry involving NORM to manage the protection of the environment as a whole and to use the tools of ICRP (e.g. reference animals and plants, representative organisms, and derived consideration reference levels) as needed in this process.